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Essays on Surgical Subjects

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ESSAYS ON SURGICAL SUBJECTS

THE MURPHY MEMORIAL ORATION*

"The moral of the whole story is this: that we should do all that we can to partake of Virtue and Wisdom in this life."—Socrates is speaking.

THIS is a day of remembrance. We have come together to do honour to one of the founders of this College, a great surgeon whose loss we mourn. You have laid upon me the duty and the high privilege of offering in your name and in my own, and if I may for the moment assume a wider responsibility, in the name of all the surgeons of his time, a tribute to the illustrious memory of Dr. J. B. Murphy.

John Benjamin Murphy was an arresting personality. Even after the briefest intercourse with him there were few people who did not realize that he possessed a curious and subtle power of impressing a sense of his character upon them. His very handsome face, his tall, spare, almost gaunt figure, his high-pitched and vibrant voice, his burning and quenchless enthusiasm for life in all its manifold activities, his power of complete self-expression, all clamoured for notice, and caught and held the most eager attention. His outlook was grave and serious; he seemed always in earnest. The little quips and sallies, the friendly taunts, the provocations to repartee, the illuminating anecdote, which in the United States dis-

* The first Murphy memorial oration delivered before the American College of Surgeons, at Montreal, October 11, 1920.

tinguish the cordial intimacies of daily life, did not seem to play around him as freely as around other men. Even in a crowded room of busy men, or when a debate was keen he would steal a few moments for a whispered conversation, held aloof, on some topic that for the moment filled his thoughts. Among those who knew him well he was admired and deeply respected, rather than loved. Except to a very few he was not genial or responsive in friendship. His intellectual attainments were so considerable, and his position in the judgment of his contemporaries so secure, that jealousy hardly touched him, except perhaps in his earlier years and from a few among his seniors whose supremacy he challenged. Such jealousy is perhaps the tribute paid to youth for successful enterprise in thought or in action by minds which suffer from the atheroma of advancing years. We are reminded of the aphorism of Sir Walter Raleigh

> "For whoso reaps renown above the rest
> With heaps of hate shall surely be opprest."

Murphy was beyond question the greatest clinical teacher of his day. No one who listened to him can ever forget the experience. Before his audience arrived he had everything very carefully prepared, diagrams in order, microscopes ready, the patients examined, and all relevant literature at his finger ends. There he stood in the middle of the circle, in the theatre, with his assistants and friends in the first row and the other benches packed to the roof with eager students, or with medical men, who came again and again to learn from him afresh. As he began to speak one felt a strange sense of disappointment, and even of dismay. For while the handsome face and upright figure were things of real beauty, the voice in

which he began to speak was quite unpleasant. It was harsh, even raucous, high pitched, shrill, apt to wander into other keys. It seemed strange that a man of Irish descent, and of so gracious and commanding a presence, should have a voice so lacking in softness, one which not only did not appeal, but actually displeased and almost repelled every listener. But as he continued speaking the voice gradually ceased to distract, it became smoother, quieter, and more evenly pitched, and all thought of it was now lost in rapt attention to the matter. For things were happening even while one's first emotions were roused. Questions were being asked and answered, often with great rapidity, then would come a pause, in which with marvellous directness and power the lesson to be learnt therefrom was driven home. The rally began again. A poor answer came, or an assistant responsible for the clinical notes had omitted to inquire upon some relevant point; raillery came in torrents, never ill-natured, never rancorous, but with just sufficient sting to leave a memory which would stimulate all future work. The discussion warmed imperceptibly; gradually the coherent chain of argument lengthened, as link after link, forged under our eyes, newly appeared; slowly there came a sense of excitement; of impending revelation; all inquiry, all disclosure, all arguments, were leading up to something that we now ached to learn. Old observations and ancient truths were taking on a new complexion; relations hitherto unsuspected were here declared and explained. The whole intellectual mechanism underlying a great subject was being shewn both in detail and in all the majesty of many moving parts. Perhaps as we drew near to the end, when the whole story would be laid bare, a question barked at one of his audience would fail

to be answered. With voice more clamorous, and almost menacing, with face strained and eager, with figure reaching forward and arm outstretched, he would hurl the question at others. Hearts beat faster, the spiritual anguish could hardly be borne. At last the answer would come, and after a final swift induction or brief summary, when the clinical journey was over, we sank back in happiness and mental repletion to wonder if Stevenson could really have been right when he said, "It is a better thing to travel hopefully than to arrive," for this journey had been happy, though anxious enough, but the haven was a rest of tranquillity, and wonder and content.

And then Murphy would operate. Now of operators there are many types, and like every other work of art, an operation is the expression of a man's temperment and character. There are still among us "brilliant" operators, from whom I pray to be spared when my hour has come. For them it is the mere quality of effort that counts. Their ideal of operative surgery is something swift and infinitely dexterous, something to dazzle the beholder, and excite his wonder that such things can so be done by human hands. The body of a man is the plastic material in which an artist works, and no art is worthy of such a medium unless it has in it something of a sacrament. Surgery of the "brilliant" kind is a desecration. Such art finds its proper scope in tricks with cards, in juggling with billiard balls, and nimble encounters with bowls of vanishing gold fish. But Murphy was of the true faith. He believed in safe and thorough work rather than in specious and hazardous brilliance. He was infinitely careful in preparation, and compared with many was inclined to be slow; but every step in every operation which I ever saw him do was completed deliberately, accurately, once

for all. It led inevitably to the next step, without pause, without haste; that step completed, another followed. "In sequent toil all forwards did contend." And so when the end came a review of the operation shewed no false move, no part left incomplete, no chance of disaster; all was honest, safe, simple; it was modest rather than brilliant. During the whole operation Murphy talked; not wasting time, but expressing and explaining aloud the quiet, gentle, dexterous movements of his hands and the purposeful working of his mind. The operation over, he would draw his stool near to the front row of the benches, cross one leg over another, rest his elbow on his knee and talk, as only he in all the world could talk, of surgery in general, of this case in particular, of his faults, of any experiment made to clear a doubtful issue. In these quiet talks there was none of the earlier passion which had gleamed through him, and which, caught up by his audience, had made them throb and tremble with suspense or joy. In them all his former experience, all that he had learnt by contact with men and books, all his native ingenuity of mind, were now bountifully displayed: the vast resources of the keenest surgical intellect of his day were now disclosed, not with ostentation or with florid pride, but in such a quiet manner as to shew that he rejoiced in the privilege of sharing with others so many fascinating and wonderful things. If in answer to a request a little intellectual gift were made to him, it was welcomed with frank, almost boyish enthusiasm, and with a delight and humility obviously genuine.

Murphy as a writer and as a speaker was prolific. Whenever he spoke men made haste to hear him. His audience, or so it always seemed to me, were often held back from quick appreciation. He was not like other

men instantly attractive as an orator. Yet, as he developed his argument, little by little, and step by step, the audience warmed to him, he interested them, he intrigued them, he dominated them, he fired them; intellectually he roused them to breathless interest; emotionally they were at times at the limit of self-control. No one could bear to miss a word, and while Murphy spoke no man left his seat. For his meaning was conveyed in pellucid language and though he might speak with the vehemence of raging conviction his thought was never obscured in a smoke of words. Such an intellectual lodestone was he that appointments were missed and hunger and thirst and fatigue were forgotten. For while Murphy expounded his gospel everything else seemed to fade in importance, overshadowed by the lessons which were now being learnt so eagerly.

I often wondered, as I listened, in what degree he resembled Lincoln. The tall, gaunt frame, and the harsh and meagre and strident voice were the same. Murphy must have been one of the handsomest men of his day; Lincoln's features were haggard, plain and homely, but his deep and glowing, sad and tender eyes no man could forget. Murphy had no such command of language as Lincoln, certainly one of the greatest orators who has ever spoken our language. But in effect they must have been alike. For they made everything else seem commonplace when they spoke, and they seemed to be delivering a message charged with truth and pregnant with confidence and hope. Lord Charnwood in his most excellent work on "Abraham Lincoln" writes of him: "His voice when he first opened his mouth surprised and jarred upon the hearers with a harsh note of curiously high pitch. But it was the sort of oddity that arrests attention, and

people's attention once caught was apt to be held by the man's transparent earnestness." How exactly was this the case with Murphy also! No one who heard Murphy speak ever doubted his sincerity. One might not agree; one might indeed profoundly and confidently disagree with some statement he made, perhaps as though to provoke a challenge, for there was much in Murphy which justified his patronymic, and which discovered his ancestry; but there was never a thought that Murphy himself was speaking other than his deep and tried conviction. He never looked at truth askance or strangely. One who heard Lincoln speak at Peoria wrote: "Beyond and above all skill was the overwhelming conviction imposed upon the audience that the speaker himself was charged with an irresistible and inspiring duty to his fellow men." Such an impression was often felt by audiences while Murphy was addressing them.

One thing Murphy lacked; in one respect he grievously failed. If we consider the qualities which go to the making of the greatest surgeons, a foremost place must always be conceded to the capacity to train great disciples. The teaching, the diligence, the general outlook upon surgery and a finished technical skill can all be drilled into the minds, and imposed upon the methods of an earnest student. But it is the inspiration, the lofty sense of a sacred mission worthy of all the best that is in you, the dedication with humblest and fullest devotion to the cause of scientific truth, and of loyal service to mankind, that are awakened with a thrill in great men by great teachers. It is here that Murphy fell short. He trained no one worthy to be his successor; no evangelist who could carry into other clinics or to other countries some of his glow, his fervour, his complete devotion, or the full meaning of

his gospel. For this great omission there were perhaps some compensations. There were few clinics in any part of the world in which something taught by Murphy or inspired by him had not crept in and found a home. His name was often on the lips of surgeons in all lands. His views impressed themselves on men's minds. His methods were closely copied. But when Murphy laid his mantle down there was no one ready and worthy to take it up. When we remember how the pupils of Turner, of Edinburgh, became professors in most of the chairs of anatomy throughout the British Empire, how many men Billroth trained to occupy with great distinction the chairs of surgery in eastern Europe, how Welch is the happy parent of a great school of pathologists trained by him, inspired by him, and looking to him with reverent affection, we cannot refrain from regret that some of the acolytes of Murphy did not grow to the stature of High Priests.

Year by year Murphy grew in intellectual power and in the dominion he exercised over the minds of men. A problem took on a different aspect if Murphy were engaged in it. He touched the common currency of surgical thought and changed it into gold. For no effort of his was meaningless or sterile and all the powers of his mind and of his frail body were spent ungrudgingly in all his work. His well stocked library, and all new literature were searched for him, and dispatches made for his assimilation. He worked as all great men should work, with a clean desk. His great powers were used for worthy purposes and in due season, nothing was wasted in mere hack work, for all that could be equally well done by others was left for them to do. Yet all his life he overworked. He had an inner restless spirit which drove him at full speed. He must work, and while at work

there was only one speed, the highest he could command. "I do not wish to linger after my work is done" he said, and it was exactly what might have been expected from him.

It is useless to wish that men possessed of his qualities and capacities should use themselves differently. A man must do as he must do. If we think that Murphy by spending himself with less lavish extravagance might have prolonged his life another ten years and so have achieved even greater results, to the benefit of all mankind, we are pondering over one who was not Murphy, and who could not in those early fruitful years have been so avaricious for work, or have so generously poured forth the new truths of which he was at once both parent and missionary. Our designs for another man's life are but futile exercises of an imagination lacking in full understanding, and adrift from realities.

Such, then, was Murphy as I knew him. It is easy now to see how great a figure he was in the world of surgery of his day. When all his work is reviewed, when not only its range, but the wonderful sincerity and the permanent and piercing accuracy of so large a part of it are considered; when we remember his unequalled gifts as teacher, his power of lucid exposition and of persuasive, or coercive argument, his devotion for many years at least to experimental research, it is no exaggeration, I think, to say of him that he was the greatest surgeon of his time. Great men are fitted to their times and in many respects are a reflex of them. But as their times pass their work is seen in far perspective and may appear to shrink in significance. It may then seem to have lost all its originality, and boldness, and force, and we who stand afar off, untouched by the magnetism of a great

personality, marvel at its influence in its own day. For there are few indeed who enjoy both celebrity and fame. "Mere talents are dry leaves, tossed up and down by gusts of passion and scattered and swept away; but genius lies on the bosom of Memory." How then will it be with Murphy? Judged by the standard of his contemporaries he was an intellectual giant, but of what stature will he be when judged by the standard of history? May I ask you to bear with me while I pass briefly in review some of the main features of the progress of surgery as science and art and tell the tale of some of the great men who have laboured in it, from earliest days up to the present time, so that at last we may see how Murphy stands and what figure he will make in the Great Procession.

The earliest remains of man known to exist shew that the art of the surgeon was practised upon him. Wherever skulls of the Neolithic period have been discovered the openings made in them by the trepan are seen. Dr. Marcel Badouin, in 1908, found within a tomb discovered by accident at Belleville the remains of 120 human beings. Eight of the skulls had been trepanned, and the edges of the cut bones were smoothly healed over, showing beyond doubt that the patients survived the operation for periods long enough for this to be fully accomplished. The disc of bone removed is supposed to have been worn as an amulet. The operation of trepanning during the Neolithic period, was also performed in England, in Northern Africa, the Canary Islands, Mexico, and in Peru. It is performed today by the natives of New Ireland, to the east of New Guinea, by methods and with results apparently similar to those of the Neolithic age. Dr. Redman has presented to the Royal College of Surgeons of England a group of five skulls

shewing the effects of the operation, the instruments by which it is there performed, and the dressings applied to the wound. And travellers tell us that the operation is still practised in the ancient way, so far as can be judged, by the Quichuas of Peru. Surgery is therefore as old an art as any.

Hippocrates was the first to give form and spirit to the practice of surgery. His observations even when considered with the fuller knowledge of today often bewilder us by their accuracy, insight, and sagacity. His clinical methods judged by our modern standards were broad-based and structurally sound. He recognized not only the nobility of the art of surgery, and the worthiness of its practitioners, but was well aware of the powerful influence which the craft must exert upon the science of medicine. The divorce of hand from brain which modern custom has worked hard to effect derived neither sanction nor authority from any words of his. As he deals with the outward shewing diseases his clinical method is everywhere the same. He observes, reflects, weighs, and judges, considers his former experience of the like or analogous conditions; he suggests or discovers a general truth; he lays down principles for action, and he tells how the craftsman shall work. If the power of wide and accurate generalization be, as I believe it to be, among the supremest accomplishments of the human mind, then Hippocrates may in truth be said to have had few rivals, if indeed he has had any, among all those who in later times, and in all countries, have devoted themselves to the science of medicine. For by his injunctions as to the method of enquiry into the conditions of a patient suffering from any disease he lays down for the first time the principles upon which inductive research is founded. He is the parent

not of medicine alone, but of the inductive method as applicable to all branches of natural science. It is a proud claim that the method found its first application in the science of medicine.

His observations upon cerebral injuries were hardly bettered until our own day, and many of his instructions as to their treatment cannot be neglected even now. He notes the effect of brain injuries upon the limbs of the opposite side. His work on fractures and dislocations has received praise from the greatest of critics. Littrè spoke of it as "the grandest surgical monument of antiquity" and considered that the truth of its principles was eternal. A century ago the most eminent of French surgeons, Dupuytren, published a work on "Dislocations." Malgaigne, whose familiar name justly carries great weight, judged that, in respect of its discussion of congenital dislocations, the work of Hippocrates was the richer and more accurate. The discourse of Hippocrates on "Wounds," which I read once again in the early weeks of the War, seems to have, in more relations than one, a bearing upon our bitter experience of those most grievous times. Certain it is that for 1500 years afterward nothing so apt was written, by no one were the essential problems of wound treatment so well understood. The dressings applied to wounds, he tells us, were to be of new materials; water, if not clean and sweet, was to be boiled and strained before use; care of the surgeon's hands and nails was thought most necessary. Oil and wine were the balsam for a bruised or dirty wound; or for one long neglected. The accurate apposition of the wound surfaces and the exclusion of air were means to secure rapid healing by "primary intention," which was clearly distinguished from "second intention." He dreaded amputation of a limb, especially

near the trunk: these operations today are in respect of their mortality still among the most lethal of all. As Sir John Tweedy has said, "The directions which Hippocrates gives concerning the arrangements of the operating room, the placing of the patient, the position of the assistants, the disposition of the lighting, the care to be taken of the surgeon's hands, the need of ambidexterity, all indicate a careful and experienced practitioner." Hippocrates may count among his greatest glories that he recognized the essential unity of medicine and surgery, or rather that he did not distinguish between them: that he urged and practised the use of all means for the examination of the patient; that he saw no degradation as did so many later ages in the use of a physician's hands in the service of the individual patient, for whose welfare, as Aristotle said, all medicine exists. And his system, which embodied observation, reflection, judgment, all multiplied to make experience which shall decide right action, stands firm until this day. He knew its difficulties, for he tells us that "experience is difficult, verification fallible, observation long and costly, and occasion fleeting." There is one gap, however, a significant one in view of my later contention, in his method. He did not put matters to the proof by way of experiment. The experimental verification or denial of a suggested truth, or the new adventures in thought and action opened up by this method were not for him.

After Hippocrates we may take a long stride in point of time to the days of Celsus, who lived in the reign of Augustus Cæsar. It is interesting to remember that Celsus, the manuscript of whose work "DeRe Medicina" written about 30 A. D., was discovered in 1443 in the Church of St. Ambrose at Milan by Thomas of Sezanne,

afterwards Pope Nicolas V, was almost certainly not a physician. He was a noble of the family of Cornelii, who wrote works on medicine, agriculture, philosophy, law, and the art of war, in the spirit of an interested amateur. The deep prejudice of the patricians against the adoption, by one of their class, of medicine as a profession was unconquerable. And the internal evidence in all his writings is opposed to the view that he could have practised as a physician; he mocks at the value of medicine, and esteems the empirical methods of folk medicine as of equal interest and value to the academic methods of his time. He tells us that the true art of medicine lies in the correlation of theory and practice, the one guiding and controlling the other; speculation should guide thought but not determine practice. References to surgical matters are found in all the books, but Books VII and VIII are devoted exclusively to the consideration of surgical matters. The great feature of these is that they record all the changes which had occurred in our art from the time of Hippocrates and especially informs us of the great attainments of the Alexandrian school in anatomy and surgery. He describes wound treatment in detail; arrest of hæmorrhage in a wound may be effected by packing and pressure, or by the ligature, which finds its first mention in his work. Sutures are to be used to secure apposition of wound surfaces and edges, and, as a dressing, linen bandages are to be soaked in wine, water or vinegar. He gives in sufficient detail a description of operations for the radical cure of inguinal and umbilical hernia; and for the first time he refers to the removal of the testis as allowing a firmer and more secure closure of the inguinal canal. He mentions translucency as a test for hydrocele, and describes the tapping of dropsies. He quotes a large number of surgical

authors, but among them all only Hippocrates is known to us.

It is evident that by the time of Celsus the boundaries of surgery had been sensibly enlarged, that old procedures had been bettered, as in amputations, and that many new ones had been devised. But progress had been along the old lines, and was achieved by the old methods. He recorded the multiplication and the magnification of old experiences rather than the revelation of new discoveries. He it was who gave us the fulfillment of the promise of the Hippocratic methods.

But great as were these methods, and considerable as was the success attending their application, there had been a slumber of the intellectual and philosophical aspects of medicine. Hippocrates had united in his own person many divergent and opposing tendencies; after his death there was an acceptance of his teaching by various sects, each adopting a part only, and dogmatism with its cramping tendencies crept in and the spirit of investigation died away. There was need now of a philosopher with new vision, and the need was supplied by Galen. Of Galen's life and character we know much, for he was vain and ambitious, garrulous and verbose. He was trained and deeply versed in all the current philosophies. A dream of his father, Nikon, interpreted as a vision from the God of Medicine, decided his choice of a profession. After the death of his father he wandered for nine years, studying in Corinth, Smyrna, and especially Alexandria, which then attracted commerce and patients from all parts of the world. His opportunities were great and his use of them unwearying. He wrote works on anatomical and physiological matters, and attained even in these early years of his a reputation for wisdom and

sagacity. For four years he lived in Rome. His learning, his industry, his friendship with the great and the noble, brought him high repute. But the envy of his colleagues, which he did much to provoke, was his downfall and he fled in fear of his life, to return on the invitation of Marcus Aurelius some twelve years later. But Galen's chief claim to honour, an imperishable one, is that he was the first of physicians to bring experiment to the aid of medicine. As Hippocrates was the parent of inductive method, so was Galen of the deductive. He was the first experimental physiologist. It was he who first discovered and described the cranial nerves, and the sympathetic nervous system; he divided the spinal cord and produced paraplegia; he severed the recurrent laryngeal nerve, and produced the hoarseness and aphonia, which are the constant results of this injury. He discovered the function of a muscle by studying the loss of power which followed its division. He demonstrated the flow of urine from the kidney to the bladder along the ureters, by a series of experiments than which nothing today could be more conclusive. And he trembled at the very edge of a great discovery when he wrote: "If you would kill an animal by cutting through a number of its large arteries you will find the veins becoming empty along with the arteries; now this could never occur if there were not anastomoses between them." Unhappily experiment alone did not content him, nor experiment in close alliance with clinical observation. His knowledge of anatomy, unsurpassed by any of his time, did not keep him aloof from the wildest speculations in natural philosophy. It is interesting to learn from him that the art of dissection was mainly, if not wholly, confined to certain families, among whom tradition and instruction give rise to a *caste* of

dissectors. The members of a family were, from their childhood, exercised by their parents in dissecting, just as familiarly as in writing and reading, so that "there was no more fear of their forgetting their anatomy than of forgetting their alphabet."

Galen's dissections were confined to the bodies of animals, and the facts so discovered were applied by analogy only to the bodies of men. If a physiological hypothesis charmed him, his anatomical observations had to give way to it. His mind ran riot in speculation, often fantastic and far-fetched, but occasionally shewing a gleam of real insight, as, for example, in his belief that there was a close primary correspondence between the sexual organs of the male and female. But the evils were great and lasting. It was his rash conceits rather than the facts of his experiments, or his sound anatomical knowledge, and broad scientific purpose which were remembered, and indeed almost sanctified, by all men for a period of over 1500 years. Though he was the first of experimenters he asserted that speculation should lead experience and he exalted a debased metaphysics to a height exceeding that of strict and sober observation. In the times of intellectual stagnation in the Dark Ages the writings of Galen had an enequalled authority; and it was only by a notable independence that Abdollatif dared to assert that anatomy was not to be learnt from books and that even Galen's observations were less to be trusted than the evidences of one's own senses. The result was the sterility and the abasement of medicine until the experimental methods were revived by his direct intellectual descendant, William Harvey.

In a rather different sense, and in a different scene, the great traditions of medicine were handed on by Avicenna,

who was born in Bokhara about 980 A. D. It was through him that the works of Hippocrates and Galen became widely known through the East, and finally filtered back to Europe through the Arabs and Moors at a time when learning and culture had almost vanished. The Arabian mind was essentially concerned with compiling knowledge from all sources rather than in initiating enquiry; and a great and useful work, in this direction, was carried out by them during the brightest days of the Saracen Empire. The modern world indeed owes much to their careful preservation of knowledge and their multiplication of copies of standard medical works, before the era of printing; even though the science and art of medicine in itself did not, through their efforts, advance one step. In Avicenna we find a mind as keen as that of his great predecessors, viewing the human body and its ailments in his own way, although numerous points of resemblance to the works of Galen and Hippocrates are everywhere evident. He was not an experimenter so much as a philosopher and the power of his mind over so many later centuries is probably to be attributed to his masterly grasp of all sciences as well as of medicine and surgery. In the art of surgery he can hardly have attained the skill of the great founder, as far as can be judged by the records in the Canon. We do not find all those evidences of mastership in technique which shine so strongly through the writings of Hippocrates. As is characteristic of the Eastern today the knowledge which he possessed and, to judge by the records of his successes, utilized with great practical effect, was of a different order, both intuitive and logical, but intuitive before logical. His skill in dealing with fundamental mathematical problems is hardly surpassed at the present day, and in this respect he has been almost

the only instance of a great mind applying mathematical concepts to medicine and surgery, up till the present era.

Of other writers before the sixteenth century, it is not unfair to say that they all, or almost all, were merely recorders, encyclopædists it may be, but devoid of any spark of new thought or of wise generalization. They preserved with reverence the old tradition and the ancient knowledge, they discussed every device, and, at interminable length, the meanings of the old scriptures; they tortured new meanings out of old phrases, they were diligent in dressing old words new, and their scholarship was judged by their ingenuity, or infinite prolixity, in so doing.

The anatomists of the Middle Ages prepared the way for new enlightenment. The oldest treatise on anatomy comes from Egypt. The papyrus dates probably from the reign of Thutmosis I, that is, from before the crossing of the Red Sea by the Israelites. It shews the heart with vessels proceeding from it, the liver, spleen, kidneys, ureters, and bladder. The first of comparative anatomists was Aristotle. The expedition of his pupil Alexander into Asia, which he accompanied, gave him unprecedented opportunities for the study of many animals; the result of his work is contained in several books. The first dissections of the *human* body were made by Erasistratus and Herophilus, of Alexandria. Under the Ptolemies in Egypt were garnered all the fading philosophies and sciences which amid the dissensions and distractions of life in Greece, could no longer flourish there. Alexandria then became the guardian and the host of all the sciences and the literatures of the world. It was here, as we have seen, that Galen learnt much of his anatomy.

After the darkness of succeeding centuries the first

gleam of dawn was seen in the University of Bologna. For over 100 years it had been renowned as a centre of scholastic knowledge, of literature and of law. Mondinus, the father of anatomy as he is always acclaimed, lectured there between 1315 and 1325, and publicly demonstrated the structures of the body as disclosed by dissection. His descriptions are remarkable alike for their extent and their accuracy. The claim has been made for him that he went near to the discovery of the circulation of the blood, for he says that the heart drives or transmits the blood to the lungs. Two centuries later (1514–1564) was born the greatest of all anatomists, Andreas Vesalius, a native of Brussels, a student at Louvain. The difficulties of performing dissections were so great in France that he went to Italy for freer and larger opportunities. "My study of anatomy," he says, "would never have succeeded had I, when working at medicine in Paris, been willing that the viscera should be merely shewn to me and to my fellow students at one or another public dissection, by wholly unskilled barbers, and that in the most superficial way. I had to put my own hand to the business." When twenty-one years of age he was asked to lecture at the University of Padua. His original additions to the science of anatomy were numerous and of the highest importance. He swept away much of the old "analogical" anatomy, the surmises and the errors, hoary with age, and sanctified by their free acceptance by a multitude of authors in the centuries after Galen formulated them. His work on anatomy is adorned with illustrations which for beauty of design and accuracy of execution have never been surpassed, indeed, I think not equalled, since they were published. It is said that the figures were drawn by Titian. Cuvier remarks that if this be not true they

must at least be the work of one of his most distinguished pupils. But Vesalius did something more than all this. He was the first imitator of Galen in experimental work, and though he did little enough, it was sufficient to show that the method was not utterly forgotten. He was the forerunner of those distinguished Italian anatomists who may share with him the credit for the creation of the science of anatomy, of Eustachius, of Fallopius, who in his short life labored to great ends, and of Fabricius, his successor in the chair of anatomy and surgery of Padua, among whose pupils was William Harvey. The presence of folds in the interior of some veins had been noted by Sylvius and Vesalius and others, and those of the vena azygos were particularly described by Canani in 1547, but it was Fabricius who recognized the existence of valves throughout the venous system and who observed that they were all turned towards the heart.

Harvey had been attracted by the fame of Fabricius to Padua, at a time when Galileo was teaching and was engaging in those methodical researches whose influences have lasted to our own day. Harvey said of himself that he felt it in some sort criminal to call in question doctrines that had descended through a long succession of ages and carried the authority of ancients, but he "appealed unto Nature that bowed to no antiquity, and was of still higher authority than the ancients." It was at the instigation of Fabricius that Harvey undertook by experiment to discover the function of the valves in the venous system, and in the year of Shakespeare's death those experiments whose end was to bring about the greatest discovery in the history of medicine were begun. The discovery had almost been made by half a dozen of his predecessors who appeared to have stood upon its very brink. As Cuvier says, we are

often on the edge of discovery without suspecting it. There can be little doubt that the pulmonary circulation had been recognized by the unhappy Servetus, who, with his works, was burned as a heretic at Geneva in 1553 by Calvin.

In 1559, a pupil of Vesalius at Padua, Realdus Columbus, may be said to have suggested the existence of this circulation by inductive reasoning, but to ingenious speculation the minds of men were hardened. It was open demonstration and proof that were needed to press home an opinion so contrary to all accepted teaching.

A discovery is rarely, if ever, a sudden achievement, nor is it the work of one man; a long series of observations each in turn received in doubt, and discussed in hostility, are familiarized by time, and lead at last to the gradual disclosure of the truth. Harvey's discovery was finally due to his application of the experimental method of Archimedes and Galen to a problem of which many of the factors were already known; or, as he himself tells us, the circulation of the blood was held to be completely demonstrated by experiment, observation, and ocular inspection against all force and array of argument. He writes: "When I first gave my mind to vivisections, as a means of discovering the motions and uses of the heart and sought to discover these from actual inspection and not from the writings of others, I found the task so truly arduous, so full of difficulties, that I was almost tempted to think with Fracastorius, that the motion of the heart was only to be comprehended by God. . . . At length and by using greater and daily diligence, having frequent recourse to vivisections, employing a variety of animals for the purpose, and collecting numerous observations, I thought that I had attained to the truth."

The reception of this discovery was generous at home; tardy and reluctant, or openly hostile abroad. But it was everywhere eagerly and hotly discussed. Harvey says: "But scarce an hour has passed since the birthday of the circulation of the blood that I have not heard something for good and for evil said of this my discovery. Some abuse it as a feeble infant, and yet unworthy to have seen the light; others again think the bantling deserves to be cherished and cared for. These oppose it with much ado, those patronize it with abundant commendation."

Riolan, distinguished as an anatomist, and professor at the College de France, denied and derided it. What Harvey felt of the opposition may be learnt from his reply to a friend who urged upon him the publication of his later work, *De Generatione Animalium:* "And would you advise me to quit the tranquillity of this haven, wherein I now calmly spend my days and again commit myself to the unfaithful ocean? You are not ignorant how great troubles my lucubrations, formerly published, have raised. Better it is certainly, at some time, to endeavour to grow wise at home in private than by the hasty divulgation of such things, to the knowledge whereof you have attained with vast labour, to stir up tempests that may deprive you of your leisure and quiet for the future." Nevertheless, compensations and rewards came to him in full measure, and he had the satisfaction of living to see the general acceptance of his discoveries. This discovery, as Whewell said, implied the usual conditions, distinct general notions, careful observation of many facts, and the mental act of bringing together these elements of truth. Boyle wrote: "I remember that when I asked our famous Harvey what were the things that

induced him to think of a circulation of the blood, he answered me that when he took notice that the valves in the veins of so many parts of the body were so placed that they gave a free passage to the blood toward the heart, but opposed the passage of the venal blood the contrary way, he was incited to imagine that so provident a cause as Nature had not placed so many valves without design; and no design seemed more probable than that the blood should be sent through the arteries and return through the veins whose valves did not oppose its course that way. That supposition his experiments confirmed."

But the experimental methods of Galen, revived by Gilbert, physician to Queeen Elizabeth and the father of modern experimental science, and practised with such supreme effect by Harvey, was to find as yet no place in scientific surgery. That art it is true was practised with wider scope, with confidence bred of generations of experience, and with a risk that was perhaps steadily, though almost negligibly, diminishing. Safety was rather dependent upon the individual capacity of the surgeon than a quality common to the work of all. Richard Wiseman, who was born three years after the publication of Harvey's discovery, is generally granted the proud title of the Father of English surgery. He was a man "given to the observation of Nature" and became Sergeant Surgeon to Charles II and to James II (who when Prince of Wales and Duke of York were withdrawn under a hedge during the battle of Edgehill, October 23, 1642, when Harvey distracted their thoughts by reading to them), and among his contributions to the craft of surgery may be mentioned his operations for hernia, and his advocacy of primary amputation in cases of injury, by gunshot or otherwise, of the limbs.

Ambrose Parè was to French surgery what Wiseman was to British. The life of Parè is one of the greatest romances in the history of our profession; it tells the story of the progress of the son of a joiner who was groom, gardener, barber's apprentice, until he became at last the surgeon to four kings of France. It was he who was concealed, locked up in a room of the Louvre, and spared from death by special order of Charles IX at the Massacre of the Huguenots on the day of St. Bartholomew. For the King said that it was not reasonable that a man who was worth a whole world of men should be murdered. He is the outstanding medical figure in the Renaissance. He was untaught and therefore in youth at least free from the trammels of ancient lore. Early in life he said: "I make no claim to have read Galen either in Greek or in Latin; for it did not please God to be so gracious to my youth that it should be instructed either in the one tongue or in the other." At last when he read Hippocrates and Galen he surpassed them both in the number and variety of the conditions he had been called upon to treat; and he was therefore the better fitted to approach their teaching in the spirit of an informed and practised critic. "We must not be drugged by the work of the ancients as if they had known all things or spoken all," he writes. Yet in later years he studied diligently, for he was said by Thomas Johnson, who translated and edited his works, to be "a man very well versed in the writings of the ancient and modern physicians and surgeons." He was one of the greatest original minds our art has known, fearless, independent, alert and inventive, and not without a good conceit. "There be few men of this profession," he writes, "which can bring so much authority to their writings either with

reason or experience as I can," and again, "I have so certainly touched the mark whereat I aimed that antiquity may seem to have nothing wherein it may exceed us beside the glory of invention, nor posterity anything left but a certain small hope to add some things as it is easy to add to former inventions." He won for surgery and for those who practised the craft in France a place they had never before attained.

Surgery was still lacking its firm foundation in pathological anatomy. This was to be built by Morgagni and John Hunter and by many others taught and inspired by them. The tireless industry, unwearying care, and profound sagacity of John Hunter gave to an art that was largely empirical a warrant based upon a sound knowledge of morbid processes in all tissues. He was observer, investigator, collector, in each capacity without a rival. He was unceasing in his search for truth by way of experiment. "Don't think, try the experiment," he urged his pupil Jenner. In his own person he did both supremely well. His disregard of the written word was deplorable no doubt, but refreshing after so much barren speculation among his forerunners. "I am not a reader of books," he said; and again, "I believe nothing I have not seen and observed myself." His rebuff to one who accused him of ignorance of the classics is famous: "Jesse Foot accuses me of not understanding the dead languages, but I could teach him that on the dead body which he never knew in any language, dead or living." Often he recounts the details of an experiment, but leaves us to draw the conclusion. He changed the whole spirit of practice and placed knowledge on the throne of authority. The day was gone forever when a pure and dangerous empiricism could be practised; surgery became a science and

its craft a rational procedure. The museum which he founded and which still bears his name in the Royal College of Surgeons of England is unsurpassed in all the world, and his own specimens are still to be seen to bear witness to his incomparable services to pathological anatomy. For Morgagni no praise can be too high. His letters may be read today with delight; though his knowledge of disease is, in the modern view, often steeped in mediævalism, his long array of facts and of relevant instances, his description of morbid parts, his accurate and searching generalizations are among the greatest contributions to medical literature in all the ages.

Such was the progress of surgery up to the early years of the nineteenth century. The discovery of the anæsthetic properties of ether and chloroform completely changed the possibilities of the range of application of surgery to morbid conditions and enlarged also the scope of experimental work upon animals. But in every direction the surgeon's work was hampered and frustrated by the occurrence of infection and all its dire consequences, in the majority of the wounds inflicted. It was for Lister that the world was waiting and his coming changed everything. For, as Carlyle said, "The great man was always as lightning out of Heaven: the rest of men waited for him like fuel, and then they too would flame."

Lister, as every one knows, introduced the antiseptic system into surgery. Before his time the wounds inflicted by the surgeon, or those received in civil life as in cases of compound fracture, became septic almost as a matter of course. The decomposition of the wound discharges was formerly held to be due to contact with the oxygen of the air. Lister recognized that the investigation of many observers, ending with Pasteur, which shewed that fer-

mentative and putrefactive processes depended upon minute organisms, were applicable in surgical work also. In the year 1836, a French observer, G. Latour, had pointed out that the tiny particles of which yeast was composed were capable of multiplication, that they were in fact alive, and that it was by their propagation that the change known as fermentation, the change of sugar into alcohol, was produced. Both Latour and T. Schwann shewed that this process could be suppressed by the application of heat to the yeast. Schwann, especially, called attention to the fact that the putrefaction of organic substances was due to these minute living bodies, and that putrefaction and fermentation were essentially one. The weighty authority of Liebig was opposed to this view, and Helmholtz, after a time of wavering, finally ranged himself against Schwann. It was in 1856 that Pasteur began the series of experiments which demonstrated finally that micro-organisms were the cause of fermentation and of putrefaction, and that for each form of fermentation studied by him—yeast fermentation, lactic acid fermentation, butyric acid fermentation—there was one specific cause, and only one.

Lister had long been working on the problem of inflammation and of the decomposition of wound discharges. When, therefore, early in 1865 he read of the work of Pasteur his mind was prepared to receive the new evidence, and to put it to the proof in the treatment of surgical cases. It is impossible for us now to realize the horrors and the mortality attached to surgical work at the period when Pasteur's papers were written. In almost every case the discharge from a wound underwent putrefaction; inflammation of varying degrees of severity attacked the wounds, pus poured from their surfaces, and hospital

gangrene, erysipelas, and pyæmia, the most desperate form of blood poisoning, occurred with terrible frequency. The clean healing of a wound by "first intention" rarely occurred. A surgeon was more than content, he was eager and gratified, to see a thick creamy discharge of "laudable pus" from the surfaces of a wound. Very few operations were performed, and then, as a general rule, only in cases where death or extreme disability was otherwise certain. Limbs were amputated when smashed, or diseased as to be worthless and dangerous; the mortality from amputations varied from 40 to 50 per cent. In Lister's hands, up to the year 1865, in 15 cases of excision of the wrist-joint by his own method, 6 patients suffered from hospital gangrene and 1 died from pyæmia. Volkmann, one of the earliest of Lister's disciples, had results so ghastly that he decided to close his hospital altogether for some months. Lister's own account of his wards at Glasgow is disturbing and distressing even today. The most vigorous and robust patients were swept away after the most trifling injuries or operations, and septic diseases were so frequent and so deadly that the very name of hospital was dreaded by every sufferer. John Bell, a great surgeon, spoke of the hospital as a "house of death."

In the paper which Lister had read, Pasteur asserted that "the most far reaching of my researches is simple enough, it is that putrefaction is produced by living ferments." He asserted that the oxygen of the air was not the cause of putrefaction, as everyone hitherto had supposed; that indeed some of the causes of decomposition could thrive only in the absence of oxygen. This observation, which distinguishes "aërobic" from "anaërobic" organisms, is of the first importance. Lister at once realized the significance of this work in connection with the

changes occurring in wound discharges and on wound surfaces. In 1867 he wrote: "When it had been shewn by the researches of Pasteur that the septic property of the atmosphere depended not on the oxygen or any gaseous constituent, but on minute organisms suspended in it, which owed their energy to their vitality, it occurred to me that decomposition in the injured part might be avoided, without excluding the air, by applying as a dressing some material capable of destroying the life of the floating particles." He proceeded to make trial of the hypothesis in his own work. At this time he had heard also of the experiments made at Carlisle with the disinfection and deodorization of sewage by German creosote, a crude form of carbolic acid. The administration of a very small proportion of this substance not only prevented all odour from the lands irrigated, but destroyed the entozoa which usually infest cattle fed upon such pastures. This was the preparation he decided, after trying chloride of zinc and the sulphites, to rely upon in his early trials.

Among surgical cases then, as now, the sharpest distinction was drawn between simple and compound fractures; between fractures, that is, where the soft parts are almost unhurt and the skin unwounded, and fractures in which a wound through the skin and soft tissues reaches the broken ends of bone. In simple fractures, life was rarely or never in jeopardy; in compound fractures, putrefaction of wound discharges occurred, septic processes became rampant and the mortality was high. "The frequency of disastrous consequences in compound fractures, contrasted with the complete immunity from danger to life or limb in simple fracture, is one of the most striking as well as melancholy facts in surgical practice."

These were the opening words of Lister's first paper on the "new methods" in the *Lancet* in 1867. The first trial of this method proved disastrous owing to improper management, but the second attempt, on August 12, 1865, proved perfectly satisfactory, and was followed by others which more than realized Lister's most sanguine expectations. Compound fractures healed and united as easily and quickly, and almost as safely, as simple fractures. The method proved by so stern a trial was soon applied to cases of chronic abscess, and by degree to operation wounds. In one of his earlier papers Lister wrote: "Admitting then the truth of the germ theory and proceeding in accordance with it, we must when dealing with any case destroy, in the first instance, once for all any septic organisms which may exist within the parts concerned; and after this is done, our efforts must be directed to the prevention of the entrance of others into it." This statement shews that Lister laid down the two essential principles of antiseptic system, the prophylactic and the therapeutic.

Lister's work, it is evident, was the result of research carried out both by the inductive and by the deductive method, and tested and confirmed by many experiments. He combined in full measure the wide, patient, penetrating inquiry, the comprehensive generalization, and the sound wisdom of the method of Hippocrates, with the demand for experimental illumination or proof afforded by the method of Galen, of Bacon, and of Harvey. He combined in his own work the best of all the schools, and it was no accident that the greatest of all discoveries relating to the science and the art of surgery was made by him.

If a man's services to humanity are the standard by which we measure his value, then Lister may be counted as

perhaps the greatest man the world has ever produced. For he has been the means of abolishing, or assuaging, the sufferings of men and women to a degree which is quite incalculable, and, as I said of him years ago, he has been the means of saving more lives than all the wars of all the ages have thrown away.

As the result of Lister's work the way was cleared for an immense and immediate advance in surgical practice, and for an extension into regions that before had been denied even to the most intrepid surgical adventure. The result is known to all the world. Diseases which were beyond the reach of any are now within the grasp of all surgeons. Operations whose mortality even twenty-five years ago was so heavy as to be almost prohibitive are now performed with a frequency and with a degree of safety which never cease to excite our wonder. But Lister's work did something else; it shewed how research for the future must be conducted if our progress were to be both enterprising and safe. It shewed that clinical research and experiment must forever run together.

The achievements of clinical research have been gigantic since Lister's day. The safety which he brought into all our work resulted in an advancement, little by little, of the attack upon the diseases of internal organs, and it exercised in consequence a very powerful, germinal influence upon internal medicine. If our knowledge of the disease of the abdominal viscera of thirty years ago is compared with that of today the truth of this statement will appear. In connection with the diseases of the gall-bladder and bile-ducts the work of Courvoisier published in 1890 is a complete record: it is, indeed, one of the most monumental works ever produced in surgical literature. What was known then, in comparison with now? Nothing

of the early symptoms of gall-stones, of the relation between them and visceral and other infections, nothing of the symptoms due to the impaction of stones in one or other of the ducts; almost nothing of the possibilities of safe relief by surgery. Lister's work has not only been the means of relief to the patient in his agony, but has been the instrument by which our own most prolific enquiries into the symptomatology, etiology, and, in no insignificant degree, the pathology of this disease has been made. Of gastric ulcer as distinguished from cancer of the stomach our knowledge thirty years ago was trivial compared with what it is today. Much of the teaching of those days is not confirmed by the surgical enquiries of today; and it is now I suppose admitted universally that unless the physician is guided by the principles of diagnosis discovered by the surgeon and the radiographer he will stray wide from the path of truth. So, too, of duodenal ulcer, our present knowledge of which is due entirely to the clinical research made possible by safe surgery. And the list might be greatly extended. Much more remains to be done. We are only on the threshold of our enquiries as to the complementary action of one organ upon another; of the relations, for example, of the pancreas, spleen, and liver to each other; and of all or any of these to parts, or to the whole, of the alimentary canal, and to the organs possessed only of an internal secretion. Clinical research involves and implies the fullest enquiry into the detailed character of all present symptoms; the most searching pursuit after those earliest departures from smooth and normal action which observation can discover, the correlation of all these with the manifest changes observed at all stages in the several organs during operations upon any of them. When all

this knowledge has slowly and patiently been garnered, then the method of experiment must be used to carry our enquiries still further, and to help us to answer the question: "How do these things happen?" Clinical research will tell us of the changes in other organs associated with the one to which our main enquiry is directed, but a process of deduction and an enquiry by experiment are necessary before we can disclose the sequence of events which culminate at last in the disease we set out to study. The clinical research, is beyond question, the more arduous. The factors which enter into it are so many, so variable, so impressed by the changing conditions and moods and circumstances of the patient that only the most indefatigable patience and the most trained capacity can help to resolve the matter into simple terms, to dissociate what may be an infinitely complex grouping of many facts before we can rearrange them in appropriate sequence of process or of time. We must discover the "usual conditions," obtain our general notions, observe carefully a multitude of facts, arrange them in orderly fashion, employ the mental act which will bring them together as elements in a great truth. When this is done, and only when this is done, can the deductive method of Galen be employed to fullest advantage. Experimental research is not so baffling a task. Great ingenuity in the devising of experiments may be found in the supreme masters, Pawlow, Almroth Wright, and a very few others. But each experiment often contains only the one question to which the answer is sought. The answer is "yes" or "no," or is expressed in simple terms, and it is free from those infinite perplexities and changing proportions which distinguish the answer given to any enquiry, even the simplest, in the method of clinical research. When in a

simple experiment the answer is given, a new problem may arise suggesting a further experiment. Thus a chain of experiments may develop each of which answers not only its own question, but contributes in its own degree to the final answer embracing the entire sequence of experiments. The single experiment may be simple. But in respect of a series, each member of which is dependent upon its predecessor, and provokes its successor, and all of which illuminate or decide some problem suggested by clinical research, nothing has been done in surgery comparable to that which in chemistry has been achieved by Fisher and Abderhalden.

These brief glimpses at the progress of surgery shew that its epochs may be considered as three in number.

In the first and longest the writings of Hippocrates and Galen were regarded as an inspired gospel. By them the minds of men were held captive, and their imagination enslaved, and every new adventure in thought or action suppressed or cramped. To seek in them for knowledge was all the effort of every man. What was written in them was truth, what was outside them rank heresy. Where the meaning was not as plain as day the most endless enquiry and discussion ensued. The controversies which then shook the intellectual world to its very foundation are seen now to be only laughable, both in their methods and in their quaint decisions. In later ages to challenge the truth or the final revelation of any teaching of Galen's was almost blasphemous, and it required a rare and reckless courage to say, as did Henry of Mondeville, "God did not surely exhaust all his creative power in making Galen." The prophets and seers, who little by little, and with very needful caution, led the world through this black night, death's second self, into the dawn, were

the anatomist Mondinus, Vesalius, Fabricius, Fallopius, and others. By their work the assertions of the old scriptures could be openly gauged. In gross anatomy a structure stands out for all to see. If Galen's teaching denied the truth disclosed by dissection it was most gently and tentatively refuted, heretical and perilous as such a work might be. And as normal anatomy grew it was joined by morbid anatomy, and at last came Morgagni and Hunter. They established the second great era in which the pathology of the dead was studied with a wealth of care and inexhaustible patience. The gross lesions of morbid anatomy, and even many that were recondite and remote, were examined, described, discussed, and arranged in due order by a mighty succession of able men, whose work today we too lightly neglect. Clinical medicine and surgery were dominated by the knowledge of the morbid processes discovered in this time. Symptoms were correlated with the signs found upon the postmortem table and upon the shelves of museums. Clinical histories were largely devoted to terminal conditions, for it was only these that brought a patient to a hospital where he died, and where an autopsy could be made. But patients do not die in hospital from the diseases from which they suffer long during life. And in consequence severe limitations were set to our knowledge of disease of all kinds.

Lister's work made possible the third era which depended for its swift and notable advance upon a study of the pathology of the living, upon a study, that is, of morbid processes in their course rather than when their race was fully run. By multiplying observations made during operations we learnt, little by little, how to capture a general truth from a series of individual exam-

ples. By slow degrees and grudgingly it was admitted that terminal manifestations of disease and the advanced ravages of morbid anatomy did not constitute all medicine; that earlier symptoms were to be referred to earlier changes in organs exposed during the course of operations. And these changes and symptoms we now realize are themselves but late; still earlier manifestations of aberrant action are being sought patiently and with a success that holds increasing hope for future work.

During all these three periods, through Galen, Vesalius, Harvey, Bacon, Hunter, Lister, there has run a vein of experimental work, testing hypothesis and discovering new truths. Since Lister's day there has been a steadily increasing recognition of the value of such work and of the urgent necessity of continuing it, of enlarging its field so that it may be coterminous with medicine itself. We are, indeed, newly entered upon another stage, the stage of combined research, in which clinical observation, inductive and deductive processes of reasoning, and experimental enquiry are linked together. In its progress, so far, the work of a few men stands out as of the utmost significance. Horsley's work upon myxœdema, cretinism, and on the functions of the thyroid gland; Ferrier's, Macewen's, and Horsley's researches upon cerebral affections and cerebral localization; Senn's work upon the pancreas and upon the intestines; Kocher's work upon cerebral compression and upon the thyroid gland; Crile's work upon shock and upon blood transfusion; and Harvey Cushing's work upon diseases of the brain and the pituitary gland. Since Lister rid all operations upon man and upon animals of their former terrors, many surgeons have turned to experiment in order to perfect and to illustrate their own work, to test an hypothesis, to search for new

procedures or to discover an explanation of clinical phenomena whose meaning was difficult to unravel. In recent days few men have displayed so vast a range of clinical interests, so keen a zest for relevant experimental enquiry, so logical a mind, such frank intellectual honesty as Murphy. He may justly be ranked as one of the earliest and one of the greatest exponents of the method of combined research.

Murphy's first work to attract the attention of all surgeons was that which led him to devise and to perfect the most exquisite surgical implement that has ever been invented, "Murphy's button." Up to the time at which experimental work on the anastomosis of hollow abdominal viscera was begun by Senn, Murphy, and others, the method of securing union was difficult, tedious, and unsafe. I well remember to have seen the operation of "pylorectomy" done in the year 1889. A very niggardly removal of a small "prepyloric" carcinoma was made, and the cut end of the duodenum was united to a part of the divided end of the stomach after the first method of Billroth. We counted over two hundred sutures used to effect the junction. Each suture was of silk; for each the needle was separately threaded, the suture passed, tied, and cut; a wearisome total of movements of the surgeon and his assistants, involving a great expenditure of time. No wonder the surgeons searched for simpler methods. Senn's bone plates, the first mechanical apparatus to assist in an anastomosis, were ingenious instruments not very easy to use, requiring a not inconsiderable degree of skill and patience to secure, that the threads holding them were well and truly tied, and calling also for the introduction of a number of additional sutures. The results following the use of these instruments were some-

times very good and sometimes very bad. While surgeons were struggling with this tiresome and unsatisfactory implement, Murphy introduced his "button." It was the result of a great deal of experimental work done upon dogs, in the early hours of the morning, and in the lean years of his early married life. In this work Mrs. Murphy took her share, giving chloroform to the animals. A few people were privileged to know of the boundless help and inspiration which Mrs. Murphy gave her husband in those hard, but happy days when he was struggling for his place in the world of surgery. His wonderful success was in no small way due to her sympathy, encouragement, and unfaltering belief in him; and to the eager enthusiasm which she shewed in all his work. His fame was her fame also. As I offer to him my tribute of laurel for honour and of rosemary for remembrance, it is an added pride that I can do so in her presence. With the help of Murphy's button operations which had been difficult and perilous at once became so simple that the merest tyro could perform them, and the risk of all operations fell with amazing rapidity. The button was used in every clinic and upon all occasions where visceral anastomoses had to be effected; and the name and the fame of Murphy travelled round the world. But I still think that the great virtue of the button was not in its own direct use, but in the convincing demonstration it gave to us of the essential simplicity of the process of visceral union. By using the button we learned how safely and how rapidly the peritoneal junction took place; there was no need, it was now perfectly evident, for the hundreds of stitches that all surgeons were using. Firm, even approximation for a very few days would lead, the button showed beyond a doubt, to a permanent and secure fusion of the apposed viscera.

The button itself was occasionally a danger. After the operation of gastro-enterostomy it sometimes remained for many months in the stomach; when it passed on to the lower intestine it might cause obstruction, or it might ulcerate its way through the intestinal wall. We learned from the use of the button not that the button itself should be used, but all the secrets of the principles of entero-anastomosis. It is not the least exaggeration to say that Murphy revolutionized the methods of visceral anastomosis, and was partly responsible for giving that impulse to abdominal surgery which in later years has carried it so far.

A characteristic example of his method of approaching a surgical subject to which he desired to contribute is shewn in his work on "Ankylosis," which he began in 1901. Up to that time the treatment of stiff joints was unsatisfactory, and in cases of severe ankylosis, whether bony or densely fibrous, was almost hopeless. Murphy says he proposes to begin the study of his subject by some questions: "What are joints? What is the embryology of joint formation? What is the pathological histology of aquired arthoses, of false joints? What is the pathology of hygromata? (acquired endothelial lined sac) Can they be produced artificially? What is ankylosis? What are the pathologic and anatomic changes included in the term? What tissues are involved? From a practical standpoint, into what classes may it be divided? When ankylosis has formed, what are the limitations of surgery for its relief? Can we re-establish a movable, functionating joint with synovial lining? Can we restore motion, and to what degree? In what class of cases can the best results be secured? Can we for the future

promise better than the flexible, fibrous unions that we have secured in the past?"

He then discusses the development of joints in the embryo, and the method of bursa formation in early and in adult life, shews that hygromata and ganglia are the products of the liquefaction of hypertrophied connective tissue, and indicates that in an artificial development of joints all the facts relative to these processes should be utilized. The formation of "false joints" as a result of non-union in fractures of the long bones led to the recognition of the pathological condition whose counterpart was provoked in the operation of arthroplasty, in which a foreign body was inserted between the end of bones separated at an ankylosed joint, to prevent reunion and to cause the development of a new joint. He then investigates the matter by experiments upon dogs, and proceeds to demonstrate its efficacy upon men afflicted by bony ankylosis of their joints. The whole piece of work is an exemplary instance of the combination of clinical experience and of experimental research leading to the establishment of a new method of treatment in a severe and most disabling condition.

In 1897, Murphy published his article, "Resection of Arteries and Veins Injured in Continuity. End-to-End Suture; Experimental and Clinical Research," in which for the first time he established the principles, and described one of the methods, of arterial suture and anastomosis. As in other articles, clinical needs indicate the lines of his experimental enquiries; and a widening of the bounds of surgical endeavour and practice is the result. In 1898, he delivered at Denver the Oration on Surgery before the American Medical Association and chose as his subject the "Surgery of the Lungs." Independently

of Forlanini he suggested the injection of nitrogen into the pleural cavity in cases of hopeless unilateral disease of the lung. No enthusiastic acceptance greeted the suggestion. Murphy himself extended the method in his later work to cases of incipient tuberculous disease; and recent experience has fully justified all his claims and has given sanction to his methods. He again combined clinical experience and research by experiment in his work on "Surgery of the Spinal Cord," published in 1907, and his final summary on neurological surgery in *Surgery, Gynecology, and Obstetrics*, 1907, iv, 385, was the most accurate and concise survey of our knowledge of this subject which had then been published.

Wherever we turn we find his method to be the same. A wide survey of the subject to be discussed made interesting by the personal magic that he was able to throw into it; a disclosure of the gaps in our knowledge; a suggestion as to the means by which that knowledge or a want in our technical methods can be made good; a record of experiment to elucidate or to solve a difficult point; a wealth of clinical observation and a formidable array of arguments, lead to an inevitable conclusion stated in terms that none could fail to comprehend. In every article of his that we read we can see the working of an orderly mind, of a mind most eager for new truths, and expectant of them. For every subject he seems to have a mental scaffolding by which he guides and arranges the truths as they are fashioned and duly laid in place. He had a zeal for classifications which looked complex, but when carefully considered tended to simplicity and to easy and ready remembrance. Of his other surgical work and of his high-minded endeavour to seek for and to secure the purity and advancement of his own profession

I need say nothing. It is a record of sincere and honest devotion to his duty as he saw it before him. Great deeds are born of great zeal and high resolve; and he was lacking in neither. All that he did is within the recent memory of his colleagues here. My immediate purpose has been fulfilled if I have sketched, however roughly, the giant figure of the man and the surgeon whose work was done among you and whose fame has spread out into all lands.

Our calling by common consent, the noblest of any, dignifies all who join its ranks. The honour of the profession is the cumulative honour of all who both in days gone by and in our own time have worthily and honestly laboured in it. In every generation there are a chosen happy few who shed a special lustre upon it by their character, their scientific attainments, or the great glory of their service to their fellow men; for it is, as Ambrose Parè said, "beautiful and the best of all things to work for the relief and cure of suffering." In our generation Murphy was one who by his full devotion, his complete surrender to its ideals, and by his loyal, earnest, and unceasing work, added distinction to our profession, which, in return, showered upon him the rewards with which no others can compare, the approbation of his fellow workers and the friendship and trust of the best among his contemporaries in every country.

"The mightier man, the mightier is the thing
That makes him honoured."

As we look backward upon the long history of the science and art of medicine we seem to see a great procession of famous and heroic figures, each one standing not only as a witness of his own authentic achievements, but

also as a symbol of the traditions, ideals, and aims of the age which he adorns. The procession is sometimes thinly stretched out, or even rudely broken here and there, but in happier ages it is thronged by an eager and exultant crowd. In medicine the whole pageant is as noble and splendid as in any of the sciences or arts, and it reveals the collective and continuous genius of a band of men inspired by the loftiest purpose, and lavish in labour and sacrifice for the welfare of mankind. They have come throughout the ages from every land. They now belong not to one country but to every country, for they are the common possession and the pride of all the world. They have lost their nationality in death. They are men whose deeds will not be forgotten and whose names will live to all generations. Among such men, few in number, supreme in achievement, John Benjamin Murphy is worthy to take his place.

THE RITUAL OF A SURGICAL OPERATION*

EVERY operation in surgery is an experiment in bacteriology. The success of the experiment in respect of the salvation of the patient, the quality of healing in the wound, the amount of local or constitutional reaction, the discomforts during the days following operation, and the nature and severity of any possible sequels, depend not only on the skill but also upon the care exercised by the surgeon in the ritual of the operation. The "ritualist" must not be a man unduly concerned with fixed forms and ceremonies, with carrying out the rigidly prescribed ordinances of the surgical sect to which he owes allegiance; but a man who, while observing with unfaltering loyalty those practices which experience and experiment have together imposed upon him, refuses to be merely a mimic bound by custom and routine. He must set endeavour in continual motion, and seek always and earnestly for simpler methods and a better way. In the craft of surgery the master word is simplicity.

The ritual of an operation commences before, sometimes long before, the incision is made, and may continue for a long period after the wound is healed. In the transition of a patient from ill health to sound health the operation itself is only one—though it may be the most important—of all the factors concerned in this fortunate event.

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* Remarks made at the opening of a discussion at the first meeting of the British Association of Surgeons, held at the Royal College of Surgeons, May 14, 1920. Reprinted from The British Journal of Surgery, Vol. VIII, No. 29, 1920.

THE MURPHY MEMORIAL ORATION

MURPHY, J.B.